

Insulation Material

Spacecraft, manned or unmanned, are subjected to temperature extremes that may range several hundred degrees above or below zero Fahrenheit. Thus, they need superior insulation to protect their on-board equipment and instrumentation. On-orbit thermal control requirements are not the same for all types of equipment, so there is considerable variance among the types of insulation NASA has developed over a quarter century.

An example of a high efficiency superinsulator, used to protect experiments and pressurized modules in the open cargo bay of the Space Shuttle Orbiter, is multilayer insulation, or MLI. Developed in the mid-1970s by Marshall Space Flight Center, the MLI "blanket" employs multiple radiation barriers to retard the flow of energy. This is accomplished by metallizing the surfaces of the barrier material, causing them to reflect radiant energy—retaining wanted heat and blocking unwanted heat or cold. The radiation barriers consist of a plastic film coated on both sides with vapor-deposited

layers of metal, such as gold or aluminum. A typical MLI blanket, one that covers the Shuttleborne Spacelab manned laboratory, is composed of 19 layers of "goldized" plastic film separated by layers of dacron netting. The layers of netting reduce loss of energy by convection and serve to hold the blanket together.

Apex Mills Corporation, Lynbrook, New York, a manufacturer of nettings, meshes, scrim and fabrics for industrial use, is a NASA vendor which has been supplying space insulation materials, including netting for MLI, since the late 1960s. The company put this experience to work by adapting the MLI insulation theory to an advanced insulation system—called Texolite®—for consumer and commercial use.

The basic Texolite product is a five-layer insulator, with three layers of netting and two layers of metallized film (aluminized polyethylene). A heavier version for extra insulation is Texolite Plus®, a sandwich containing outer layers of netting covering vacuum-plated film and a core of fiberfill. In the top photo, a sample of the basic Texolite, pulled apart to show the netting, is at upper right; a Texolite Plus sample is at lower left in the photo.

The two products are used in window energy applications as liners for curtains that reduce heat transfer to the insides of buildings and block escape of cool conditioned air, or retain warm air in the heating season. They are also



used by makers of cold weather apparel—parkas, jackets, boots—and outdoor gear, such as sleeping bags; their attraction in such applications is that radiant barrier insulation offers excellent warmth retention at minimal weight and bulk. ▲

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